ANTI-MALARIA WORK IN MACEDONIA

AMONG BRITISH TROOPS

BY

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PREFACE

At the close of the second malaria season during which British troops have occupied part of Macedonia we thought it might be interesting to describe some of the aspects of the anti malaria work carried on in and near one large section of the front

The continued prevalence of so much malaria in spite of the persistent efforts of the R A M C and others is a matter for regret This regret is however mitigated by the knowledge that the work resulted in an improvement in 1917 as compared with 1916

The account in the following pages is not intended as a scientific work but is simply a record of personal practical experience which may possibly we hope be of use to others called upon to do anti malaria duties in this difficult country

To make the account more complete for those with little previous knowledge of malaria we have added a brief description of the mosquito and its connection with the disease

W G W
L. C

November 1917

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ANTI-MALARIA WORK IN MACEDONIA

CHAPTER I

MALARIA AND THE MOSQUITO

MALARIA is due to a microscopic organism whose life-history is only complete when it has existed in the human being and in a mosquito While apparently any human being is a useful medium for this organism it is selective as regards its definitive host the mosquito and only thrives in certain species of these insects

At least three varieties of the organism cause malaria *Plasmodium vivax* causes benign tertian *P malariæ* causes quartan and *P falciparum* causes malignant tertian malaria

The mosquito hosts of the plasmodia are anophelines There are various varieties of anophelines some of which act as hosts and some do not The chief malaria transmitting species in one country may not be so in another country

In Macedonia the chief anophelines we have found have been *A maculipennis* and *A superpictus*

A pseudopictus and *A bifurcatus* and possibly others also occur

The aim of this work being to describe practical prevention of malaria we do not propose to discuss the important question as to how far any particular species is concerned with any particular form of illness This matter is being investigated by scientists

From the association of certain forms of malaria with the seasons and places of finding certain species of anophelines particularly prevalent it is likely that *A superpictus* and *A pseudopictus* are responsible especially for malaria of a malignant type but practically there need be no local selective process in the work of destroying mosquitoes even if all those engaged in the work had the requisite knowledge

The complete extirpation of one variety of mosquito in any locality will involve that of the others also since their habits and mode of development are to this extent sufficiently alike In any event all mosquitoes are nuisances they may be carriers of other diseases besides malaria and should therefore be destroyed

The course or cycle of infection is briefly as follows An anopheline mosquito infected with the plasmodium in biting transmits the organisms from her salivary glands to the blood-circulation of the human victim After the lapse of about twelve days these organisms have so multiplied and have so acted in connection with the red blood cells that the symptoms of malaria appear

The individual thus bitten becomes later on a carrier of organisms unless he has had very thorough treatment a chronic case being more dangerous in this respect than an acute case

When this infected person is again bitten by a mosquito requiring blood for the development of her eggs she at the same time sucks in with the blood a number of the organisms These are sometimes altered in that they have taken on a sexual character and in the stomach of the mosquito exercise their sexual functions

The resulting progeny eventually find their way from the stomach to the salivary glands of the insect and are in readiness for injection into another human victim and the cycle is complete

The course of events in the mosquito itself lasts from ten to twelve days and a temperature of at least about 60 F is said to be requisite for the process

Only the female mosquito bites man she must have blood for the development of her maternal activities She can take over a cubic millimetre of blood at a time and we are informed that this quantity of blood from a favourable human subject may contain thousands of organisms The male insect is apparently a vegetarian and harmless except for the breeding of more females

The cycle of infection briefly described above which is often complicated by repeated biting is the only mode of spread of malaria scientifically demonstrated at present and gives the clue to the necessary basis for preventive action

It indicates that in addition to the plasmodium itself which cannot be dealt with apart from the *mosquito or the blood of the human victim* there are three principal essentials for a case of malaria These are the infected person from whom the mosquito originally obtains the plasmodium the mosquito of the particular species by which this can be transmitted and thirdly the victim

In Macedonia infected persons abound among the natives and now also among our own men The transmitting species of mosquito also abound our troops are the victims

In our account of preventive methods we therefore discuss the destruction of the mosquito in all stages of its life-history and the protection of the troops the potential victims As regards the infected individual who starts the cycle much can also be done to render his infected state a lesser danger to the community

In the case of the infected natives especially children isolation and removal from the neighbourhood of our men is practicable and has been carried out to a great extent at the front In the case of our own infected men who cannot be removed from the district the points to be aimed at are their cure by very thorough quinine treatment and *their thorough protection* from further mosquito bites so that the infection cannot be passed on to others

Another method of defence that requires attention is that of rendering the infected bite harmless to the victim by the use of *prophylactic drugs especially*

quinine Though important this is obviously but a subsidiary resource to be employed when other methods are not sufficiently practicable to be efficient

A working knowledge of the course of development of the mosquito its life and habits is necessary before the various means of prevention can be put into satisfactory operation

The common species of mosquitoes in Macedonia are anophelines various varieties of which can transmit the malaria plasmodium and culicines which are apparently harmless as regards malaria

The life-history of the anopheline is briefly this The adult insect lays her eggs on the surface of water after about two to three days the eggs hatch into larvæ which in their turn become pupæ in from about seven to ten days The insect emerges from the pupal stage after another two to three days The time of the complete cycle is therefore from about eleven to sixteen days It is important to bear these times in mind in planning destructive processes

The larval stage is very important in anti malaria work for it is that in which destruction can be most easily carried out Larvæ are easily seen being from about one-quarter to half an inch in length They constantly come to the surface of the water but can remain below for some time so that search should not be abandoned too quickly Sometimes when they are not at once seen a gentle movement of the weed or other contents of the water will cause them to show themselves

The commonest anopheline larva in our area was a small very dark one with a light neck the larva of *A superpictus* Weedy streams were a favourite haunt of this variety The larger lighter larva of *A maculipennis* was also common especially early in the summer Occasionally other species were found The *A pseudopictus* found in the marshy borders of a lake was apparently associated with the severe type of malaria in the vicinity

The principal breeding time is from mid June to the end of September but larvæ have been found even in the winter months Mid September seems to be the culminating point of the breeding most cases of malaria in our district in any one week in 1917 were notified in the beginning of October

The anopheline larva is said to prefer shady clear and stagnant water with weeds in it This is so especially as regards weeds but we have found these larvæ in any and every variety of water in Macedonia

The anopheline mosquito bites as a rule in the twilight and at night We have however seen them biting in the daytime in darkened places such as dug outs They remain in dark places and in undergrowth during the day Anophelines have been found in large numbers in the day shelters as well as in the quite dark dug outs they may be seen on the walls and ceilings They are found among clothes and bedding between the layers of double tents and also in shelters such as helmets Heavy rain drives them into buildings in large quantities

The anopheline bite is less irritating than that of culex

Mosquitoes strongly object to wind and are found chiefly to leeward of their breeding places They travel much farther than the half mile which has been sometimes mentioned as their limit of flight

A temperature of 60 F is said to be necessary for the changes in the plasmodium inside the mosquito though winter cases seem to show there may be exceptions

The anopheline mosquito hibernates during the winter months in dug outs and dark parts of buildings It is said that she can retain during this time her infecting organisms ready for action in the following spring, and summer In Macedonia how ever there is abundant material for fresh infection of anophelines all the year round

The following are some practical points in distin guishing the anopheline or malaria mosquito from the culicine

(a) The Insect —The anopheline alights on and rests on a surface with its body at an angle to it the common forms in Macedonia have spotted wings the female s palp is about as long as her proboscis

The culicine s body is nearly parallel to the surface on which it alights its wings are clear and the palps quite short

(b) The Larva.—The anopheline when at the surface lies parallel to it on the water its head is small compared with the thorax and it projects no siphon

The culicine larva lies under the water at an angle of about 45° with the surface through which the siphon projects the head is large and the lateral hairs plain

(c) THE PUPA —The siphon tubes of the anopheline are broad and situate at the middle of the head end of the pupa in the culicine they are longer not so broad and situate at the back of the head

(d) THE EGGS —In anophelines the eggs are in sets of about 100 in irregular patterns in culicines the eggs are about 250 in number set vertically in rafts of about one-fifth of an inch in longest diameter

Rapid differentiation is only practically easy in the larva and insect stages but there is for most anti malaria workers among the troops no need to dis criminate, but to kill any and every mosquito possible in any stage of its existence

ANOPHELINES	CULICINES
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ILLUSTRATION COMPARING ANOPHELINE [illegible] CULICINE

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CHAPTER II

PREVALENCE OF MALARIA

As the object of this work is to give an account of anti malaria work in a large part of the area in Macedonia occupied by our troops it would be more complete if it included statistics showing the extent to which the disease has prevailed

On the other hand under present circumstances obviously no figures can be given which might indicate numbers of troops We are confined therefore to mentioning certain of the broad facts within our experience It is common knowledge that the troops of all nations operating in Macedonia suffer considerably from malaria Statistics on the subject will no doubt be available at the end of the war

The smallness relatively of the casualty lists that appear in the Press in connection with the Salonika Force has apparently sometimes given the uninformed the mistaken idea that the troops on this front have had an easy time In proportion they have had a considerable share of fighting but the casualty figures are dwarfed by those of sickness due to malaria

There are few men who would not gladly exchange out of malarious Macedonia Front line troops have

not only fighting to do but are continuously exposed at night and sometimes by day also, to the bites of thousands of small enemies which cannot be adequately dealt with because their breeding grounds are in no man s land between the opposing forces or because of other difficulties indicated later on

The malaria *following the bites* disables men for a time as surely as a wound (without the compensating *gold stripe on the sleeve*) recurrences are common and a long and tedious convalescence often ensues In this way a large proportion of the troops have to carry on knowing that in the unavoidable absence of complete precautions though the bullet may miss its billet the mosquito will probably not do so

Behind the front line anophelines are still so omni present that notwithstanding unceasing anti malarial work the troops are everywhere exposed nightly to the chances of infection though much less so than at the front (except in certain areas) A few districts of the occupied portion of the country are almost free from infected mosquitoes but in most parts they abound and in none is there absolute immunity

The circumstances in 1917 were more difficult to contend with than in 1916 in this important respect that owing to the cases of the previous year infected carriers were to be found in almost all units

In spite of this there has been an appreciable decrease of malaria among troops in the area to which this book refers and probably elsewhere also In September a very satisfactory percentage of men was

saved for active service as compared with September 1916 When the great increase of material for infecting mosquitoes is considered together with the fact that the same partly untreatable malarious districts had to be still occupied it will be understood that a great increase of malaria might have been expected rather than a decrease had not the continuous antimalarial work had a good measure of success

The curve of weekly notifications of the cases of malaria removed to the base hospitals was at its lowest in the beginning of January and at its highest in the second week of October Allowing a fortnight for the development of the disease and a week s delay in notification and blood examinations this points to a maximum biting season at mid September

Recurrences due to other causes than fresh infection by biting probably do not affect the accuracy of this as a general proposition

It is not possible to distinguish for statistical purposes between recurrences due to chills heat fatigue or other similar causes and recurrences due to renewed infection by biting

When the curve was at its lowest in January in the region with which we are dealing about 1 man in 1 000 weekly was evacuated to the base with malaria at its height early in October the proportion was 1 in 30 or less In addition there were many cases not severe enough for evacuation beyond the area Many of the cases were repeated recurrences in the same individual

CHAPTLR III

NATURE OF THE COUNTRY

THE natural characteristics of the part of Macedonia occupied by British troops conduce to malaria The country is mostly mountainous with many separate hills of varying height in each range The ravines and valleys are therefore very numerous and contain in the aggregate an abundance of water At the foot of the hills there are large plains through which the water has to find its way to lakes and to the sea The number of ravines in both hills and plains is quite a feature of the district They intersect in all directions the many semi isolated hills which rise to heights varying from about five to sixteen hundred feet above the plains In the parts immediately beyond those occupied by our troops the hills and ranges are occasionally very much higher

In the ravines the watercourses are narrow with frequent rocky pools The water is overhung with vegetation Though the current may be strong there are weeds and many quiet off shoots in which larvæ are found

In the plains the large volume of water in winter

PLATE I



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and in sudden storms has worn very deep and in places very wide stream beds These stream beds are only partially filled with water in the hot malaria months There are then large pools and patches of stagnant water generally full of weeds The stream itself has often no very definite channel but spreads over its wide bed forming weedy shallows which with the isolated ponds offer an irresistible attraction to the mosquito for breeding purposes Streams in a sandy bed often end abruptly and reappear lower down the channel having run for varying distances under the surface. Depressions in the bed are filled with water and form breeding places

The lakes in the district have in places large surrounding patches of marshy ground overgrown with rushes and weed and containing here and there pools of open water These marshes are so full of dense vegetation and are so water logged that the mosquito has an ideal place in which to thrive both in its insect and larva stages of existence One of these marshes is many square kilometres in area and a much used road runs for some miles along its border Military exigencies required that in the summer of 1917 camps should be situated near this particular marsh The men temporarily living in these camps and those using the road at night were particularly exposed to mosquito bites

In the case of another large lake the border marsh is smaller but adjoins a portion of the front line occupied by British troops

There are other smaller areas of marshy ground which are not such difficult problems in anti malarial work These are sometimes caused by a spring rising on level ground or by a stream ending blindly on a level without a natural outlet

Ponds and pools abound especially in ravines and beds of streams In the latter the bottoms of the pools are often below the level of the remnant of water in the stream Such incidents as removal of sand for road making or hoof marks of horses and mules in the river beds cause pools to form which quickly become breeding places

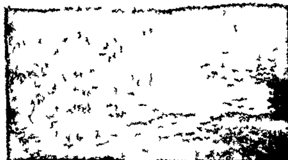
In the ravines of the hilly country rocky dams cause the formation of sheltered pools in which there may be a slight current which is not strong enough to prevent the hatching out of mosquitoes

Springs are plentiful Every village has at least one public fountain fed by a spring Similar fountains are also found here and there at a distance from villages The Turks were very good at providing water supplies In a fair number of fountains the flow is constant all the year round and the unkempt waste forms semi stagnant water logged areas which are soon adopted for breeding purposes in the summer by the mosquito Wells are less common but there are many of them and these also may become infested with larvæ

The almost universal presence of all forms of natural accumulations of water in the district has its import ant uses but from an anti malarial point of view

PLATE II





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necessitates much constant labour To this has to be added the necessity for constant attention to the abundant collections of accidental water in such places as old tins horse-troughs tubs and irrigation channels Any form of water comes handy to the ubiquitous mosquito if the water is left without attention for a sufficient number of days

VEGETATION —The universally abundant vegetation along the banks of the streams and lakes is useful to the mosquito as a resting place by day Trees in most of our area are not common The abundant long grass and rushes form very convenient shelters for insects of all kinds In the hilly districts a small oak scrub bracken and dense brakes of undergrowth are found in and near the ravines When a stream has to be channelled especially in the plains the overlapping undergrowth has first to be cut away At times this was necessary before we could even see the water which required attention

So great was the amount of long grass and other weeds in 1917 even apart from the neighbourhood of water that wholesale prairie fires had to be organised on an extensive scale

The wholesale destruction of villages in the various Balkan wars has done away with much of the artificially cultivated vegetation and favoured the growth of weeds

Vegetation in the water itself flourishes Rushes and water-grasses are common A particularly ubiquitous and rapidly growing green water weed re-

sembling a loose piece of cotton wool in consistency and lying entirely in the water enables larvæ to enjoy a comfortable existence even in a fairly fast flowing stream The larvæ of *A superpictus* particularly flourished in such positions If a stream bed that has been canalised is not cleared of this weed in particular at regular intervals the value of canalisation is to a very great extent lost

CLIMATE —The great heat of the Macedonian summer favours mosquito life In July August and September the average temperature is well up in the nineties in the shade The nights remain warm and the heat is a humid one A shade temperature of 106 8° F was recorded about 2 p m which is usually the hottest period on one day in August There were others of over 100° F from time to time

Rain during these three months was rare The rain of large thunder storms is useful in destroying mosquitoes and their larvæ but resulting water requires attention and channelling requires repair

THE INHABITANTS —In addition to the ideal natural conditions for its existence the mosquito has another advantage as a malaria transmitter in the state of the inhabitants These who are very mixed and include Bulgars Greeks and Turks must be practically all malaria carriers The number and extent of the village cemeteries bear eloquent testimony to the ravages caused by this disease The survivors, especially the children very often show their saturation with malaria in their faces Another marked feature

about the children is the protrusion of the abdomen due to their enlarged spleens The lack of energy displayed by the Macedonian Greek though probably very much the result of living in such a hot enervating climate and of having many generations of malarious ancestors is largely due to the effect of his own particular attacks of malaria

When a female anopheles bites any of these people she can hardly fail to miss absorbing some of the plasmodium organisms which she will inject into her next victims who may be British soldiers Fortunately there are not many natives near the front

Villages abound but many of them are tenantless having been destroyed in the various wars The grass overgrown ruins afford many hiding places for hibernating mosquitoes and for those driven in by rain and by artificial fires

It will be seen from the above that owing to the natural characteristics of the country and of its inhabitants the mosquito has an easy task in transmitting malaria while the anti malarial worker has a correspondingly heavy one

CHAPTER IV

ANTI MALARIAL MEASURES ADMINISTRATION

THE organisation that had been adopted in the area to which we were attached was very complete

The Deputy Director of Medical Services at the head of this organisation had a system of workers which could only fail in efficiency by individual neglect this if it happened could be soon detected The Assistant Directors of Medical Services were responsible in their respective divisions

Divisional areas were divided into districts with the officer commanding a Field Ambulance responsible in each These officers appointed malaria medical officers from their units to superintend anti malarial work in the areas from which they collected and evacuated sick and wounded

Beyond these were the regimental medical officers who were *responsible for their units and their battalion* areas as regards malaria and superintended the anti malaria squads of their units when such existed

Outside the above direct chain but connected with it were the sanitary sections attached to the corps and divisions which co-operated in the work

Beyond the divisional areas the O C corps head quarters sanitary section during the summer of 1917 *acted as a special anti malarial officer for the corps* area and was responsible for the drainage canalisation and other treatment of all forms of water in his district

The A D M S (sanitary) and some experts general or temporarily attached also made frequent surveys and were available for consultative purposes

Reports were sent in weekly by the various officers as to the nature and progress of the anti malarial *measures taken The reports were accompanied by* maps Monthly reports were also sent in by some of the anti malarial officers.

The question of labour for anti malarial work was a serious one Where possible the regimental units had to supply the necessary men for dealing with water within a reasonable distance (generally half a mile) of their respective camps It has been assumed that half a mile is about the limit of flight of a mosquito but wind and other circumstances affect this limitation and there are very many exceptions. It is not a safe rule on which to depend

Various military requirements interfere from time to time with the use of soldiers for ordinary anti malaria work but it is an important duty and may be much more valuable than some of the other drills or duties. Only the executive commanding officers can have the responsibility of deciding as to the best method of using the men in fighting areas Many of

them have given very *sympathetic help* *It would be* far preferable to have a permanent skilled anti malaria squad of workers These could be formed indepen dently and attached for the special work

Behind the lines civil labour under skilled direction is an excellent method of carrying out the work The natives can work all day whereas the soldier new to the climate and handicapped by other duties can only work within limited hours The natives moreover are accustomed to draining and ditching They have to be adequately superintended to work well

The value of natives in anti malarial work has not been nearly enough appreciated Applications to military authorities for native labour were received with much demur With much pressure a squad of twelve natives was allotted in July in one area where such work as channelling was badly needed These twelve Turks did much good work and for one or two weeks through persistent requests and refusals to be put off the use of a large number of short time local prisoners was obtained

At the time when only twelve natives were allotted in an urgent period of the malaria season over twelve hundred were employed in repairing roads in the same limit of district Prevention of malaria just then should not have been rated at one-hundredth the value of the repair of roads

CHAPTER V

REMOVAL OF MEN FROM MALARIOUS AREAS

HISTORY has shown that there have been times when military and other operations have had to be abandoned owing to the ravages of malaria Recent history in Panama and elsewhere has shown that the knowledge of the connection between malaria and the mosquito has ended this helpless position where the necessary money and labour are forthcoming

In Macedonia the malaria problem is complicated by the fact that some of the worst mosquito haunts and breeding places lie within the fighting zone and this limits the possible extent of anti malarial measures Outside the fighting zone the destruction of mosquitoes and other means of lessening malaria are matters of time labour and expense

In the Struma district in 1916 the impossibility of adopting sufficient measures made it advisable to adopt another line of front Elsewhere the military advantages outweigh the disadvantages through illness particularly as this latter is proportionately decreasing owing to the measures taken

Although it is necessary for the troops to remain in

this malarious country and fight on a malarious front, much illness can be prevented by care in choosing camp sites for the many troops not actually in the front line

We think that more could be done in this direction In choosing sites away from the front line it is advantageous to keep a proper sense of proportion between the importance of malaria prevention and that of *military convenience* as apart from *military necessity*

In any case expert medical advice should always be obtained in the anti malaria interest even if for *military reasons it must be eventually disregarded* A *via media* may be arrived at in some such cases which may reduce the number of cases of malaria without detriment to military interests

The neighbourhood of water for example is always important for camp sites especially for those units with much animal transport The trouble and inconvenience however of carrying water for some distance from a malarious stream to a camp would in many instances be well repaid by a lessening of the number of cases of malaria

As regards efficiency of the unit the repayment through health may be very great, as regards expense the laying in of a pump and pipes or the carrying of water for a distance by mule labour is obviously far cheaper than the unending cost of sick men and their attendants, and of the resulting reinforcements necessary

We have in mind an animal transport unit where

the sickness through camping near a river bed must have far outweighed the advantages from proximity of water Practically all the officers and men had malaria at some time with frequent recurrences

Camps should be well up a hill Mosquitoes dislike wind. If there is a prevailing wind a site on the windward side of the water should be chosen and as far from it as possible The half mile limit sometimes advised is a useful working figure but to be varied according to circumstances especially in the direction of an increase of distance.

Whenever possible men should be away from the neighbourhood of water in Macedonia after sunset In most camp areas some portions are more free from mosquitoes than are other parts In the long summer evenings we have seen men bathing in and sitting too near to the water after sunset The beauty of some of the ravine streams and the coolness of the water are temptations to running risks by remaining by them after sunset

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CHAPTER VI

DESTRUCTION OF THE ADULT INSECT

WHILE the mosquito is most easily destroyed in large quantities in its larval stage much malaria may be prevented by the systematic destruction of the adult insect itself As the female anopheline lays about 100 eggs at a time the destruction of a female adult particularly is as valuable as that of many larvæ The haunts of the insect by day are especially undergrowth such as weeds and long grass and places sheltered from the light

Clearing undergrowth by cutting and burning especially along stream beds is generally possible and very much has been done in this direction Prairie fires have been very extensive and useful In some places near the front clearing and burning cannot be carried out Undergrowth is often a protection from observation The men of a unit that had a sharp bout of malaria had about a fortnight previously been engaged in putting up wire in dense grass

Our troops do not occupy many buildings at the front but a favourite day haunt of the mosquito is the universal dug out used by the men for sun

protection or for shelter from shell bursts There are necessarily many of these places of all sizes and shapes which possess the attributes of shelter coolness and absence of light in various degrees Very dark dug outs in the ravines harbour many mosquitoes

Prairie fires and heavy rain tend to drive the mosquitoes into such places Destruction of mosquitoes in buildings and dug outs can be carried out by fumigation with sulphur in the proportion of 1 pound to 500 cubic feet of space Burning of cresol is also useful Spraying with 1 per cent solution of formalin or other insecticide is effective For this purpose the foot sprayer is better in practice than the knapsack sprayer Syringing is not so useful

Anophelines will bite in the dug outs during the daytime We have seen one biting the wrist of an officer at midday though there was enough daylight in the dug out for ordinary purposes Anophelines hide in accumulations of such articles as clothes and bedding and between the layers of double tents A Greek church used for services required regular disinfection for mosquitoes shortly before each day s occupation

In the dug out the entrance of which is illustrated by one sweep of a small net along the wall eight mosquitoes were caught The place was thoroughly fumigated and none were then found Within thirty six hours mosquitoes were as prevalent there as before A single fumigation only deals with the insects present The process does not prevent

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others from adopting the shelter almost at once The effect of formalin is most lasting in this respect but ceases when it also ceases to be unpleasant to men.

The openings into dug outs should be covered with mosquito-proof netting after fumigation spraying or otherwise clearing out the insects and to be effective this netting should be in constant use This applies especially to dug outs used regularly as day shelters

Individual mosquitoes may be caught and killed at twilight in rooms or dug outs through their tendency to fly to the windows or nets over the openings They can also be killed on wall surfaces during the day especially near sunset and sunrise

Tents and bivouac nets should be examined night and morning for mosquitoes In cases of defective or insufficiently closed nets the mosquitoes found in the morning are often full of blood

' Fly papers are of a very limited use Placed near window openings or by the lamp mosquitoes may be caught on them towards evening as well as very many of the ' sand flies which also cause a troublesome fever

The hibernating mosquito should be specially sought out and destroyed during the winter It will usually be found in the dark corners of unceiled roofs cellars outhouses etc

The electric torch or other light should not be brought too close to the insect if the mosquito is to be killed with a fly flap Mosquitoes can also be driven

out into the cold When possible however destruction is better than driving out the insects Each building in a locality should be systematically examined about every fourteen days starting from early in November Double tents and dug outs should also be dealt with by periodical taking down and fumigation respectively

Articles such as blankets and clothing should be shaken out from time to time We have known biting to follow the opening of bundles of clothing

Although cases of malaria in the following spring are often instances of relapses it is quite possible that they may be fresh infections due to mosquitoes that have hibernated

CHAPTER VII

DESTRUCTION OF THE EGGS LARVÆ AND PUPÆ

THESE forms of the mosquito are more easily destroyed in quantities than are the adult insects The problem of their destruction resolves itself into one of dealing with the open water of the district

The anopheline wishing to lay its eggs is said to have preferences for certain conditions as regards the water it selects clear still and shady waters have been mentioned in this respect. We can confidently state that for practical purposes no open water must be regarded as above suspicion We have found anopheline larvæ in all varieties of water—in running as well as in stagnant water in dirty as well as in clear water and in water open to the sun as well as that in shady pools We remember two shallow pools in particular one in a sandy bed and one in a rocky ravine in which there was not a vestige of weed and which were quite unshaded Each contained very large numbers of anopheline larvæ whose shadows were distinctly reflected on the sandy bottom of one and the rocky bottom of the other

In the marshy districts surrounding the lakes the

PLATE III



RUSHE AT HE L KE R



) TREAM BEL V TH MA S EEDY HALLOW OL
A F VORITE RREDI G GND

extensive breeding grounds are very difficult to deal with. In these situations the marsh is seen at its worst There are two large lakes in the area in which we served one of them being about forty square kilometres in extent The marshy portion of the borders of this latter is in the front line and so cannot be adequately drained or otherwise treated A certain amount of oiling could however be carried out with advantage The marshy area of the other lake s borders is about twelve square kilometres in extent A main road runs along it for some miles and it is necessary for there to be various camps in the vicinity In the marsh around this lake the water logged soil is full of rushes and other shorter vegetation The rushes are eight feet high in places and they and the undergrowth are so densely packed together that evaporation is almost nil There are some patches of open water in this area Nothing short of a large and costly scheme could render this marsh free from the mosquitoes which abound there

If this district must still be occupied by the army to such an extent as it was in the summer of 1917 we think that the problem of improving the state of the lake border should however receive considerable attention The men of the units who had to live near and work along the adjoining road suffered very considerably from malaria

It is to be feared that the magnitude of the work the expense and the difficulty of getting labour are prohibitive as regards this swamp but we think

something of considerable effect might be done in the direction of reducing the amount of vegetation and by oiling parts adjoining the shore where the larvæ are mostly found At least numbers of the pest might be destroyed and it is here that a mosquito was found apparently associated with a bad form of malaria in adjoining units

In the open water of the lakes the larvæ have not such favourable circumstances for development since the movement of the water owing to wind is injurious to them Drowned mosquitoes can be seen to the leeward side of large water surfaces still entangled in their pupa cases

RIVERS —Fortunately it is only in the case of the large lake marshes that destruction of larvæ presents what has hitherto been considered insuperable difficulties Elsewhere though many the difficulties can be and have been to a great extent overcome. In the many valleys and deep ravines due to the hilly nature of most of the occupied area the flow of water is fairly fast except in the height of the dry season In the plains the flow in the streams formed from ravine water is more sluggish The stream beds of the latter especially being large enough to take the winter water are partly empty in summer and contain as a rule a small slowly flowing often intermittent stream with many adjacent pools All the streams have irregular overgrown edges with weedy semi stagnant offshoots in which larvæ flourish

Channelling, and filling in of pools, are therefore the

PLATE IV

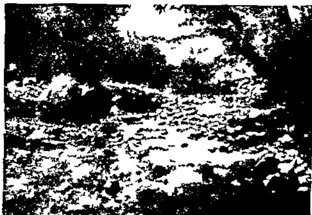


[illegible]



[illegible]

PLATE V



A.—A SMALL TREA I I A AVI E BEFO E TREATMENT MANY LARV E PRE LNT



B.—THE A IE TREA I CHA ELLED A I CLEARED OF WEED. NO LARV E

T f page 43

principal works necessary in the beds of streams The water should be confined to a space in width only just large enough to contain it without overflowing As regards depth there must be borne in mind the tendency for a channel to soon fill up with silting mud and sand

The channelling should as a rule be in the direction of the natural course of the stream otherwise overflows will occur when silting begins The banks of the channel should be made as strong as possible for animals are liable to break them down Stones are useful for strengthening these edges The channel itself should be cleared of weed In places where a stream has been flowing quite quickly we have found larvæ and pupæ among the weeds The species of fine green weed most commonly met with in these situations is easily cleared and if thrown out on to a dry surface the larvæ in it rapidly die.

The channel banks must be sharply cut Any small bay or indentation in their sides encourages stagnation weed growth and breeding of larvæ

A rocky bed is difficult to treat by channelling but the difficulties can be overcome if the general principles of a swift stream with sharply cut edges and free from weeds, are borne in mind

The formed channel is better left open than covered with stones as is sometimes done except where a bridge is necessary Defects and weeds must not be hidden from the periodical patrols.

In each stream bed, ponds and pools are to be found

with the stream sometimes ...ey are generally full of weeds and are favourite breeding grounds

Occasionally they can be drained dry by a channel into the main stream Oftener the bottom of these pools is at a lower level than the water in the stream Filling in to above the water level with earth or sand, is the best treatment for pools that cannot be quite emptied by drainage The material used should reach a height that will prevent a hoof mark from forming a little pool A permanently dry surface is also necessary from the fact that anopheline larvæ can exist in very wet sand or mud

In the instances where draining and filling in are not possible oiling may be done Crude petroleum or other oil that will make a fairly stable surface film will quickly destroy larvæ Half a pint of petroleum will make a film over about 100 square feet of surface It should be applied by a sprayer Failing a sprayer a sack can be soaked in oil weighted by a stone and thrown into the centre of the pond The oil can also be applied by slow dripping from a tin with a tiny aperture This method is useful for automatic re-application in slowly moving water, or at the wind ward edge of a pond Theoretically, once a week should be enough for re-oiling but practically oiling is not a success unless it is done about three times weekly

The drawbacks to the use of oil include the items that wind clears the oil from windward to leeward that rushes and weeds interfere with the essential

PLATE VI



[illegible] SAMPLE [illegible] COLLECTED [illegible]



[illegible] POOL UNDER [illegible]

of a spring in a level piece of ground which is water logged up to the point where a natural outlet is found A channel should be cut from this outlet as far as possible into the swamp in the hope of getting near the rising point of the spring The channel should be deep enough to drain the surface area in the immediate vicinity

In the district there is a large swamp or rather pond fed by underground springs or mountain drainage and full of rushes and other growth This pond was a fertile source of mosquitoes It is situated high in the hills in a saucer like depression in the rock and could not be drained by a channel without much blasting of rock and was too large to be filled in It was moreover within long range of the enemy s guns A six inch iron pipe siphon was fixed and reduced the depth of water by four feet Thus the surface area of water was very considerably lessened

Trenches with clean-cut edges will often collect the water of some swamps which can then be oiled or otherwise treated From all varieties of water rushes and weeds should be cleared and the undergrowth along the banks which harbours mosquitoes should be cut away and burnt

Accidental Water —In addition to the above forms of water accumulation there are various small but fruitful mosquito breeding places which are more dangerous than they seem to be at first sight Many of them are found close to human habitations tem porary or more or less permanent and consequently

PLATE VIII



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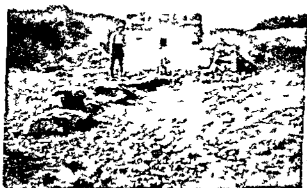


B — A H UNT OF HI ER T M ACUIT E L F DESERTED EXCEPT B ORA AN I ECT

// // A



A A DU OUT IN A PAVINE A FAVO ITE AN PHELINE HAUNT



B —A ILLAGE FOUNTAI ITH MANY LARVÆ IN THE WA TE ATER

the mosquito is near its desired source of human blood

There are very numerous native water fountains throughout the occupied area. We have often found anopheline larvæ in the overflow waste water from these. This waste water forms a marshy piece of ground which requires canalisation. The canal or channel should lead into a stream if possible, otherwise it should be led into a large pond or pit that can be carefully examined and treated from time to time.

We have found abundant anopheline larvæ in a neglected tub or half barrel containing water at a drinking supply tap fixed on a pipe in a ravine. The barrel was used to rinse vessels and to catch waste and was never thoroughly emptied. The men of the adjoining infantry unit regularly visited this fountain for water many times daily and, worse still, in the evenings. Malaria cases were occurring among them.

Finding larvæ in hoof marks along the edges of streams has been our constant experience. These accidental holes should be at once filled in.

Two neglected tubs in a vegetable-garden were found to contain many larvæ in a district otherwise comparatively free from anophelines. Water was often put into these tubs but they were never completely emptied. A fortnight after the removal of these tubs some otherwise unaccountable malaria in a neighbouring unit abated.

Any neglected tin or vessel with its opening upward and capable of containing water for over a

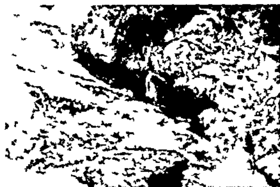
The cultivation of fish might be useful to some extent but we have continually found numbers of small fish and anopheline larvæ living apparently amicably in the same pond

Natural enemies of mosquito larvæ probably exist but do not make such an impression on their numbers in Macedonian waters as would warrant any neglect of other methods of destruction

I LATE X



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R TECT H KA LA



K OF C Y R LOWLY FLO T E M

CHAPTER VIII

PROTECTION OF THE MEN FROM BITES

It is obvious that during the course of a military campaign in such a malarious country the whole area occupied by troops cannot be rendered free from mosquitoes and their larvæ in the time and by the means at disposal It is of the utmost importance therefore that efficient measures should be adopted and properly carried out for protecting men from being bitten

First among these measures is the use of nets at night time To keep out mosquitoes the mesh of the netting fabric must be of at least twelve openings to the inch and a finer mesh of eighteen openings is preferable

It is not necessary to describe in full detail the construction of the nets used especially as experience has led to frequent improvements The important fact is that in 1917 some form of net quite efficient if properly used was universally provided

The bivouac net has been the ordinary form. Two men sleep under each net The illustration shows the arrangement The net is covered on the top by

a movable bivouac waterproof sheet and is sometimes under a sun shelter If it is kept in repair and the simple instructions with regard to its pitching and closing at night are carried out, it is quite efficient for its purpose Its handy size and light weight are *important* where *mobility* is so essential and transport facilities are so limited

A disadvantage of this bivouac net is its frailty *Strengthening bands of material should be added to* its large surfaces Another drawback is that the net is low There is thus insufficient space especially head room and *consequently men* use such expedients as that of raising the poles on stones Openings are in this way left for mosquitoes to pass through and the net may become a trap instead of a protection The best method of meeting the difficulty of head room is to hollow out the ground in the interior for about one foot in depth

Improved bivouacs are being devised as a result of this year s experience *There will be more room* and they will be more fool proof as regards the closing up arrangement

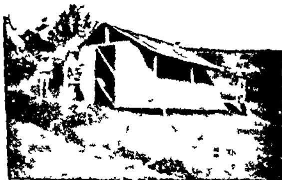
Failure of efficiency with regard to the net is due to ignorance or neglect of the occupants who from fatigue caused by heat or work or in some cases from laziness do not close the net properly at night The neglect of the occupants in not repairing accidental holes also leads to inefficient protection

On one occasion a surprise visit was made at night to a small unit and we found only three out of twenty

PLATE XI



A. T X L 1 FAC F TWO ME WITH M ML TO ET



M LIT F F CT

six nets properly closed although cases of malaria were of daily occurrence in this unit A few minutes must be occupied in closing the net properly but they are essential and the trouble is well repaid.

The night nets of any form should be in place and closed from mosquitoes at sunset After fixing it is well to make sure that no mosquitoes have accidentally been shut in

Simple as the closing process is systematic drill should take place after the trial instruction has been given The nets should be examined as to proper closure after turning in time by someone responsible and able to insist on immediate closure

Repairs should not be left to the men themselves as is usually the case but one or more men who can use the needle should be detailed for that special duty A net with a hole may become a mosquito trap

Another form of net issued to the troops this year was shaped so as to fit inside a bell tent There is more room in nets of this pattern but they possess no special advantages over the bivouac nets in efficiency against mosquitoes

Neglect to properly close the openings is common. We have found the nets of a row of seven occupied te ts all open at night and have also frequently found large holes in the nets If mosquitoes get in they are less easily caught than in bivouacs In many camps bell tents cannot be used. In bad weather this form of protection is preferable to that of bivouacs but this was negligible in that almost

no rain fell in the district during July, August and September 1917

Special mosquito proof huts with wire netting of fine mesh have been used in certain parts during the latter part of this summer They proved very successful and might be used with advantage on a more extended scale next year An illustration of one such hut is given There is much space in them and more protection from the elements

Wire netting and fine fabric mesh have been much used in door and window frames for protecting huts and dug outs This protection is not very reliable and needs frequent attention Wood warps readily in the hot sun and the edges of dug out openings are often very irregular and crumbling

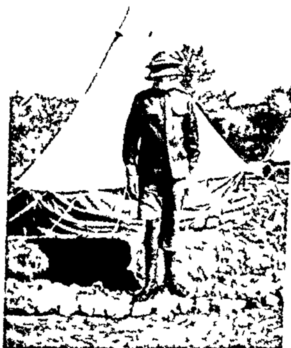
The ordinary mosquito net used over a bed with the edges tucked in can only be used in favourable circumstances

All forms of net require nightly supervision and protection A mosquito can easily bite a bare skin surface which is pressed against the net

An important point in connection with the proper use of nets is the fact that there are now so many malaria carriers amongst the troops It is essential to efficiently shield these men from bites not merely to protect themselves from re-infection but also to avoid the transmission of infection from them to others

Night nets should be used as long as mosquitoes are prevalent Fixed dates for their commencement

PLATE XII



R TECTI N VEIL GLOVE AN SHORT TURNED DOWN
VER THE BARE K EE

and discontinuance are less important than the circum stances of the year Anophelines were still biting in November 1917

FACE NETS —For men who have to work at night it is very necessary that the uncovered portions of the body should be protected in some way Veils that fit on to the cap or helmet are provided. They have each a stiff metal ring midway to keep the material from settling on the ears and nose

These nets must be properly put on We have seen men using the veil with the ring on the cap and the veil thus touching the nose ears and chin when the end was tucked into the collar band Unprotected skin surface was thus at the mercy of the mosquito

Certain work cannot be done under veils especially at the front

Gloves are also provided for night work. The wrist of the glove is not as a rule long enough unless the man has his sleeves well pulled down. Experience has led to fool proof improvements in the detail of the veils and gloves if required for another malaria season

'Shorts are universally worn in summer leaving much of the knee and thigh bare The shorts now provided have an extension which is turned up in the daytime and can be turned down over the bare parts at night In the illustration the leg of the shorts is turned down on one side There is we understand an order as to turning them down at sunset If so this order is too frequently disregarded It seemed t

PLATE XII



ROTECTION VEIL GLOVES A D SHORTS TURNED DOWN
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T f p 55

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be nobody s business to insist on this precaution being taken and the men seemed to object to the appearance of the turned down shorts

In connection with face nets the following experience that is fortunately not common may be cited For certain purposes it was found necessary to form a camp near the bed of a stream of a bad type—*i e* a sandy river bed about thirty yards wide with a sluggish stream about one yard wide spreading into pools Anopheline larvæ were very plentiful here and steps were at once taken to deal with the stream and pools We found that no face nets had been issued for the night guard This deficiency was immediately reported

Four days later on visiting the camp we found that this report had just reached the commanding officer of the unit after passing through the hands of three departmental chiefs The C O was requested by the last of these to indent for the veils He did so and the veils arrived after about two to three weeks Eleven cases of malaria occurred after the lapse of twelve days from arrival in this camp before the veils arrived Five of the affected men had been on night duty

It ought to be in the power of the medical chief to send these nets at once when necessary The medical department has too little executive power in such matters

REPELLENTS —It will be understood that there are certain military duties to be performed at night which

preclude the use of any form of face net Some ingenuity has therefore been exercised to find a material that being applied to the skin surfaces will repel mosquitoes Substances that have had at some time something said in their favour in this respect by the troops using them in Macedonia include the following

Crude paraffin

Paraquit (official issue)

Strong essential oils rubbed up in a base such as vaseline

Tar preparations

Vermijelli

The verdicts of the men using these preparations have varied considerably from quite successful to the mosquito seems to prefer those with the preparation on

Our own personal experience is that there is a short period during which these preparations repel mosquitoes and that this is the period during which the odour is strong

Oil of citronella kept off biting insects for half an hour After that period the oiled skin exercised no repellent effect

There is no doubt that on the whole repellents of the above kind are useful for a time and the first two of them seem to us to have the best effect

Without depending on them when the previously described precautions are available they must be considered useful to those who from the nature of their duties have exposed skin surfaces at night Repeated

applications of the preparation must take place especially if there is much perspiration

From practical experience we have noted that men are careless in the matter of malaria prevention despite the numbers of sick they see around them The men are too often in the ravines and near water courses in the evening By sunset all men should have left water courses bathing pools and ravines except those whose duty compels them to be there We have seen men bathing in the streams after sunset in August This was of course stopped when reported

Ignorance should be more combated There should be systematic drill in anti malarial measures The French have issued instructive and amusing posters and picture postcards on the subject We have interested many men by showing them the larvæ and explaining how the mosquito develops and how it spreads disease This might be done systematically

In this connection we may refer to the fact that two newly arrived medical officers told us that attend ance at the lectures on malaria in their recent home *R A M C* training was optional *!*

Where dug *outs* are used for shade during the day more attention should be given to killing the mosquitoes in them or to driving them out The dug out if unprotected by a *net should* be *abandoned if possible* before twilight

CHAPTER IX

QUININE PROPHYLAXIS

WHILE the efficacy of quinine in the treatment of malaria is so very marked its value as a prophylactic is a subject on which expert opinion has been varied and contradictory From our experience in Macedonia we may say at once and emphatically that the prophylactic value of quinine in the doses given has been at all events so incomplete and questionable that none of the other precautions can for a moment be neglected in favour of such practice however universally it may be carried out

Previous experience of the ravages of malaria resulted in a practically universal adoption of the taking of quinine as a prophylactic in our area during the summer of 1917 Notwithstanding this malaria has occurred in the case of a very large proportion of the men In some specially exposed units very few of the men escaped one or more attacks

Men receiving at least 10 grains of the sulphate solution twice a week and often up to 10 grains d for a long period have been taken ill with primary and recurrent We may go so far

that in the summer of 1917 practically all the malaria patients had been taking quinine as a prophylactic in these doses' This confirms the results of experimental investigations with small doses in other countries

If it were possible or advisable to give curative doses of 30 grains daily as a prophylactic instead of the doses mentioned above the effect would have perhaps been more marked and if other precautions are impossible or nearly so men might be protected in this way It is likely that the doses that have been given have lessened the number and severity of the attacks and have enabled more men to remain on duty though we can give no figures to bear this out

Thorough attention to the other anti malaria precautions would make the taking of prophylactic quinine unnecessary but this thoroughness is not always practicable owing to military exigencies

The broad facts are sufficient for practical purposes They indicate that while quinine prophylaxis should still be employed especially where other precautions are difficult reliance should be placed infinitely more on the various methods of protecting men from the bite of the mosquito

We have found that there is occasionally a danger from an excessive faith in quinine In some instances this has led to a lessened activity in the more arduous directions of prophylaxis such as proper attention to adjacent water and to keeping bivouac nets repaired and properly closed at night

In the early days of the Macedonian campaign men often evaded their quinine by not being present at the parade by being away from the centre of the unit by ejecting the quinine from the mouth and by other methods Direct refusals to take it were uncommon To make more certain of administration the medicine had to be given in solution and sometimes the device was necessary of making men swallow after taking it by requiring them to at once mention aloud their respective regimental numbers

Personal experience of malaria and its effects and the desire to avoid them has reduced to an almost vanishing point any serious wish amongst the men to neglect their prophylactic dosage though they do not like it

Of the powder tablet and solution forms of administration the last is the most certain The small amount of inconvenience is more than compensated for by the certainty of the man getting his dose and that it will not pass unchanged through the intestine as might happen with a tablet It should be given after a meal and in the evening

A method of administration generally adopted in 1917 was as follows Every man had a dose of 10 grains of the sulphate of quinine in solution on Thursdays and Sundays old malaria patients an extra two doses of 10 grains each per week and men in very malarial areas at the front where other precautions can only be partially if at all observed 10 grains per day

The question has been sometimes asked Is the

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efficiency of the men affected by prolonged dosing with quinine? The question is a difficult one and has received and is receiving attention by experts

On the whole the answer to this question is apparently in the negative Cases of cinchonism with the doses mentioned were very rare gastritis sufficiently marked to be reported was not at all common We noticed a certain amount of deafness and occasionally a slight slowing of mental effort The hard work of the front line troops in Macedonia has however gone on as usual in spite of the effects of malaria and the hot moist climate

An intelligent and tactful medical officer of a unit could easily deal with any idiosyncrasy to quinine as it arose without interfering with routine administration

An important feature of quinine prophylaxis is that in curative doses of 30 grains daily the drug might have a good effect in reducing the quantity of infective material by destroying the organism in the blood of carriers It has been proved that in small doses quinine has not much if any destructive effect on the sexual forms of the organism and these are the forms that enable the mosquito to carry on the cycle of infection

Large doses cannot be given indiscriminately until more definite information is obtained as to the possible effects of so much quinine on the constitution of the healthy individual and on his capacity for work Investigations are going on which seem likely to

dissipate the doubt we have at present as to the advisability of giving such large doses to men in arduous work

Apparently quinine prophylaxis does not interfere with the use of the drug as a curative agent when the subject has an attack of malaria

Quinine prophylaxis as at present carried out is from a practical point of view a form of malaria prevention that can only be considered an unsatisfactory refuge for those destitute of the other better forms

It is well to bear in mind that while kept up to the extent indicated during the summer of 1917 the men taking the quinine had malaria in all forms to a very serious degree

CHAPTER X

CONCLUSIONS

IT is evident from the foregoing pages that the anti malaria work of 1917 in this area has been very extensive and it was successful in limiting malaria among the troops

Military exigencies are such that it is inevitable that there must be exposure to infection and consequent malaria to some degree under the circumstances all the breeding grounds cannot be thoroughly dealt with nor can the men carry on all their night duties under nets or be always using precautions

While the above is true it is but natural that experience has shown that even more thorough and successful work can be carried out, if Macedonia has to be occupied during another summer

In addition to points alluded to in the earlier pages we venture to make the following comments and suggestions some of which are already receiving attention to a limited extent

Education of officers and men of all branches of the local army as to the causes and prevention of malaria, might with much advantage be considerably extended

Co-operation in anti malaria measures is far more satisfactory when its basis is intellectual Illustrated posters and postcards are in use in the French Army Practical demonstrations of larvæ and interesting accounts of the spread of the disease by the mosquito would lead we believe to more practical assistance from the units in exposed positions

A still closer co-operation is advisable between executive officers and medical officers expert in malaria as to camp sites where these have not to be fixed by purely military exigencies The prevention of cases of malaria may be a substantial gain in return for some inconvenience It is also possible that some twilight parades at night or morning might with advantage and without military detriment be abandoned or minimised.

A regular drill in net closing and in the use of other anti malaria measures might be instituted That this is necessary is shown by the constancy with which torn and ineffectually closed nets are found The use of the gas mask has to be taught by drill and the proportion of men gassed in Macedonia to that of men invalided by malaria is absurdly insignificant

The medical department should be able to supply right away such items as nets and veils The requisite forms could be filled in afterwards The medical department in the army has too little executive power in such respects Mere recommendations lead to delay and much unnecessary waste of time and paper

The sanitary men of units who have to look after

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In addition to points alluded to in the earlier pages, we venture to make the following comments and suggestions some of which are already receiving attention to a limited extent

Education of officers and men of all branches of the local army as to the causes and prevention of malaria, might with much advantage be considerably extended.

Co-operation in anti malaria measures is far more satisfactory when its basis is intellectual Illu trated posters and postcards are in use in the French Army Practical demonstrations of larvæ and interesting accounts of the spread of the disease by the mosquito would lead we believe to more practical assistance from the units in exposed positions

A still closer co-operation is advisable between executive officers and medical officers expert in malaria as to camp sites where these have not to be fixed by purely military exigencies The prevention of cases of malaria may be a substantial gain in return for some inconvenience It is also possible that some twilight parades at night or morning might with advantage and without military detriment be abandoned or minimised.

A regular drill in net closing and in the use of other anti malaria measures might be instituted That this is necessary is shown by the constancy with which torn and ineffectually closed nets are found The use of the gas mask has to be taught by drill and the proportion of men gassed in Macedonia to that of men invalided by malaria is absurdly insignificant

The medical department should be able to supply right away such items as nets and veils The requisite forms could be filled in afterwards The medical department in the army has too little executive power in such respects Mere recommendations lead to delay and much unnecessary waste of time and paper

The sanitary men of units who have to look after

patrol and other anti malaria work should be the best men available and not as is sometimes the case chance men perhaps unfit for other duties On the surface their incompetency may not be so noticeable as it would be in the case of other duties but in Macedonia particularly special ability and trustworthiness in these men is essential All these men should have been taught and should have been examined in the practical points as to malaria and its prevention

Canalisation and similar work should be begun earlier in the year *even in March or April* *This must depend* to some extent on the rains which destroy such work but a lot can be done as the waters subside with out lying accumulations It should be borne in mind that though in 1917 the very extensive biting began early in June there were many primary malaria cases in the earlier months of the year After a warm spell larvæ will be found. If these early mosquitoes are destroyed obviously a useful work will have been accomplished

The hibernating mosquito should receive special attention in the winter and spring months Early in *November in two days a few* intelligent men specially put on for the duty secured over 3 000 female anophelines in and near *two camps adjoining two* villages In the camps themselves the average number caught in each tent between the double layers of canvas was five and in the darkened dug outs they were caught by scores They can be caught in such shelters especially after rain Dug outs require almost daily attention

Civil labour should be used to a greater extent where politically possible If and where such labour is not available then definite anti malaria contingents might be formed from labour battalions The anti malaria work is as essential in Macedonia as the repair of roads and the labour for it should be organised just as much as that for road making and other purposes In this way skilled workers would be eventually permanently available It is hardly fair to put this labour on to front line units Even if there is time or opportunity for it to be so carried on such labour is not regular or skilled

Finally we consider that insufficient notice is too often taken of lapses of care on the part of individuals in protecting themselves and others from exposure to needless risks of mosquito bites The discovery of such items as faulty nets or neglected water courses should involve serious consequences to the offender as surely as any important military offence would do The photograph showing a bell shaped mosquito net in a tent was not taken purposely to show the hole converting it into a trap It is unfortunately an only too common sight and its conspicuous position in this case shows how little notice is taken of such neglect

The instance has already been mentioned of a night visit to a camp where it was found that only six per cent of the men had taken the trouble to close their nets properly The only censure in the case of which we heard was apportioned to the officer who

made the discovery for not properly notifying his visit before examining the nets of the unit.

There is no possible doubt that individual neglect of the simple precautions at hand has accounted for very many cases of malaria and such neglect should not be treated so lightly as it is in many cases in such a malarious country as Macedonia.

H K Lewis & Co Ltd, 1-6 Gower Street, London, W C, 1

PLATE XIII



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